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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Shuichi TAKEUCHI Group Art Unit: 2627

Appl. No. : 10/643,899 Examiner: Nathan DANIELSEN

Filed : August 20, 2003 Confirmation No. : 4641

For : OPTICAL SYSTEM WITH OBJECTIVE LENS HAVING DIFFRACTION STRUCTURE

RESPONSE UNDER 37 CFR § 1.116

Commissioner for Patents
U.S. Patent and Trademark Office
Customer Service Window, Mail Stop AF
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Sir :

In response to the Final Official Action dated December 20, 2006, setting a shortened three-month statutory period for response to expire on March 20, 2007, and having been extended by one month to expire on April 20, 2007, by the accompanying request for extension of time, Applicant respectfully requests entry of the present amendments, and reconsideration and withdrawal of the outstanding rejections and objections in view of the herein contained amendments and remarks.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) An optical system for an optical disc drive, comprising:

a light source that emits first and second light beams, said first and second light beams utilized for recording and/or reproducing data to/from first and second optical discs, respectively, the second optical disc having a thicker protective layer and lower recording density than the first optical disc;

an objective lens provided with a diffraction structure, said diffraction structure being designed to focus said first light beam on a recording layer of the first optical disc and said second light beam on a recording layer of the second optical disc; and

a collimator lens disposed between said light source and said objective lens to adjust diverging/converging angle of said first and second light beams entering said objective lens,

wherein change in spherical aberration of said first light beam caused by wavelength deviation from a design wavelength due to individual specificity of said light source is corrected by adjusting the diverging/converging angle of said first light beam emerging from said collimator lens,

wherein said collimator lens is located between first and second optimum positions, the spherical aberration of said first light beam converged onto the recording layer of the first optical disc being minimized when said collimator lens is located at said first optimum position, the spherical aberration of said second

light beam converged onto the recording layer of the second optical disc being minimized when said collimator lens is located at said second optimum position, and

wherein the collimator lens is fixed at a predetermined location during assembly of the optical system.

2. (Original) The optical system according to claim 1, wherein said diffraction structure is designed so that change in spherical aberration caused by wavelength variations of said first and second light beams due to temperature variation of said light source compensate for change in spherical aberration caused by temperature variation of said objective lens.

3. (Currently Amended) The optical system according to claim 1, wherein said diffraction structure is designed so that change in spherical aberration caused by said objective lens in accordance with wavelength variation of said first light beam is generated ~~substantially only~~ mainly by third-order spherical aberration.

4. (Original) The optical system according to claim 3, wherein said diffraction structure is designed so that change in fifth or higher order component of the spherical aberration caused by said objective lens in accordance with wavelength variation of said first light beam is less than one fifth of the third-order component thereof.

5. (Original) The optical system according to claim 3, wherein said diffraction structure is designed so that change in fifth or higher order component of the spherical aberration caused by said objective lens in accordance with wavelength variation of said first light beam is less than 0.0005 λrms/nm.

6. (Original) The optical system according to claim 1, wherein said light source includes first and second light emitting elements for generating said first and second light beams, respectively, said first and second light emitting elements being integrally formed.

7. (Cancelled)

8. (Cancelled)

9. (Original) The optical system according to claim 1, wherein said objective lens has a numerical aperture for said first light beam not less than 0.63.

10. (Currently Amended) An optical system for an optical disc drive, comprising:

first and second light sources emitting first and second light beams, respectively, said first and second light beams utilized for recording and/or reproducing data to to/from first and second optical discs, respectively, the

second optical disc having a thicker protective layer and lower recording density than the first optical disc;

an objective lens provided with a diffraction structure, said diffraction structure being designed to focus said first laser beam on a recording layer of the first optical disc and said second laser beam on a recording layer of the second optical disc; and

first and second collimator lenses disposed between said objective lens and said first and second light sources, respectively, so as to adjust diverging/converging angles of said first and second light beams entering said objective lens;

wherein said first and second collimator lenses are located so as to respectively correct change in spherical aberration of said first and second light beams caused by wavelength deviations from design wavelengths of said first and second light beams due to individual specificity of said first and second light sources,

wherein the first collimator lens is located at a first optimum position so that the spherical aberration of said first light beam converged onto the recording layer of the first optical disc is minimized,

wherein the second collimator lens is located at a second optimum position so that the spherical aberration of said second light beam converged onto the recording layer of the second optical disc is minimized, and

wherein the first and second collimator lenses are fixed at the first and second optimum positions, respectively, during assembly of the optical system.

11. (Original) The optical system according to claim 10, further comprising an optical element disposed between said objective lens and said first and second collimator lenses, said optical element combining optical paths of said first and second light beams passed through said first and second collimator lenses.

12. (Original) The optical system according to claim 10, wherein said diffraction structure is designed so that change in spherical aberration caused by wavelength variations of said first and second light beams due to temperature variations of said first and second light sources compensate for change in spherical aberration caused by temperature variation of said objective lens.

13. (Original) The optical system according to claim 10, wherein said objective lens has a numerical aperture not less than 0.63 for said first light beam.

14 – 22 (Cancelled)

23. (New) An optical system for an optical disc drive, comprising:

a light source that emits first and second light beams, said first and second light beams utilized for recording and/or reproducing data to/from first and second optical discs, respectively, the second optical disc having a thicker protective layer and lower recording density than the first optical disc;

an objective lens provided with a diffraction structure, said diffraction structure being designed to focus said first light beam on a recording layer of the first optical disc and said second light beam on a recording layer of the second optical disc; and

a collimator lens disposed between said light source and said objective lens to adjust diverging/converging angle of said first and second light beams entering said objective lens,

wherein change in spherical aberration of said first light beam caused by wavelength deviation from a design wavelength due to individual specificity of said light source is corrected by adjusting the diverging/converging angle of said first light beam emerging from said collimator lens,

wherein the diverging/converging angle of said first light beam is adjusted so as to minimize spherical aberration of said first light converged onto the recording layer of the first optical disc, and

wherein the collimator lens is fixed at a predetermined location during assembly of the optical system.

24. (New) The optical system according to claim 23, wherein said diffraction structure is designed so that change in spherical aberration caused by wavelength variations of said first and second light beams due to temperature variation of said light source compensate for change in spherical aberration caused by temperature variation of said objective lens.

25. (New) The optical system according to claim 23, wherein said diffraction structure is designed so that change in spherical aberration caused by said objective lens in accordance with wavelength variation of said first light beam is generated mainly by third-order spherical aberration.

26. (New) The optical system according to claim 25, wherein said diffraction structure is designed so that change in fifth or higher order component of the spherical aberration caused by said objective lens in accordance with wavelength variation of said first light beam is less than one fifth of the third-order component thereof.

27. (New) The optical system according to claim 25, wherein said diffraction structure is designed so that change in fifth or higher order component of the spherical aberration caused by said objective lens in accordance with wavelength variation of said first light beam is less than 0.0005 λrms/nm.

28. (New) The optical system according to claim 23, wherein said light source includes first and second light emitting elements for generating said first and second light beams, respectively, said first and second light emitting elements being integrally formed.

29. (New) The optical system according to claim 23, wherein said objective lens has a numerical aperture for said first light beam not less than 0.63.

REMARKS

Initially, Applicant would like to express his appreciation to the Examiner for the detailed Official Action provided, and for the acknowledgment of Applicant's Claim for Priority and receipt of the certified copy of the priority document in the Official Action.

Upon entry of the above amendments claims 1, 3 and 10 will have been amended, claims 7, 8 and 14-22 will have been cancelled, and claims 23-29 will have been newly presented. Claims 1-6, 9-13 and 23-29 are currently pending. Applicant respectfully requests entry of the present amendments, reconsideration of the outstanding rejections, and allowance of all the claims pending in the present application.

Applicant notes that claim 1 has been amended to include the subject matter of previous claims 8 and 22 (i.e., previous claim 22 drafted in independent form). Applicant further notes that newly presented claim 23 includes the subject matter of previous claims 1, 7 and 21 (i.e., previous claim 21 drafted in independent form). Applicant further notes that newly presented dependent claims 24-29 recite subject matter similar to previous claims 2-6 and 9.

On page 2 of the Official Action, claims 3, 14 and 18 were objected to for an informality. Applicant notes that claim 3 has been amended as suggested by the Examiner, and that claims 14 and 18 have been cancelled. Accordingly, Applicant respectfully requests entry of these amendments and withdrawal of this objection.

On pages 2-5 of the Official Action, claims 1 and 6-9 were rejected under 35 U.S.C. §103(a) as being unpatentable over SHIMOZONO in view of KATAYAMA.

On pages 10 and 11 of the Official Action, claims 21 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over SHIMOZONO in view of KATAYAMA, and further in view of TADOKORO et al.

Applicant respectfully traverses these rejections under 35 U.S.C. §103(a).

As noted above, claim 1 has been amended to include the subject matter of previous claims 8 and 22, newly presented claim 23 includes the subject matter of previous claims 1, 7 and 21, and newly presented dependent claims 24-29 recite subject matter similar to previous claims 2-6 and 9.

Claims 1 and 23 each recite, inter alia, "wherein change in spherical aberration of said first light beam caused by wavelength deviation from a design wavelength due to individual specificity of said light source is corrected by adjusting the diverging/converging angle of said first light beam emerging from said collimator lens."

In the Official Action, the Examiner acknowledges that SHIMOZONO lacks any disclosure of such feature, but the Examiner contends that such feature is disclosed by KATAYAMA.

In this regard, Applicant notes that paragraph [0154] of KATAYAMA discusses adjusting the position of a collimator lens 2 in order to cancel *spherical aberration due to variation in the substrate thickness* of a disk 7. However, Applicant submits that KATAYAMA lacks any disclosure of adjusting the

diverging/converging angle of a light beam emerging from a collimator lens in order to correct for *a change in spherical aberration due to wavelength deviation from a design wavelength due to individual specificity of a light source*.

Accordingly, Applicant submits that the teachings of KATAYAMA can not reasonably be characterized as curing the deficiencies in the disclosure of SHIMOZONO, particularly with regard to the *correction of spherical aberration resulting from wavelength variation of a light source*. Even assuming, arguendo, that the teachings of the references discussed by the Examiner were to be combined, Applicant submits that such a modified system would not result in the invention defined in the claims.

Claim 1 further recites, inter alia, "wherein said collimator lens is located between first and second optimum positions, the spherical aberration of said first light beam converged onto the recording layer of the first optical disc being minimized when said collimator lens is located at said first optimum position, the spherical aberration of said second light beam converged onto the recording layer of the second optical disc being minimized when said collimator lens is located at said second optimum position".

In the Official Action, the Examiner acknowledges that SHIMOZONO lacks any disclosure of such feature, but the Examiner contends that such feature is disclosed by KATAYAMA. Contrary to the position stated by the Examiner, Applicant submits that paragraph [0154] of KATAYAMA (as discussed above) does not teach this additional subject matter.

Claim 23 further recites, inter alia, "wherein the diverging/converging angle

of said first light beam is adjusted so as to minimize spherical aberration of said first light converged onto the recording layer of the first optical disc".

In the Official Action, the Examiner acknowledges that SHIMOZONO lacks any disclosure of such feature, but the Examiner contends that such feature is disclosed by KATAYAMA. Contrary to the position stated by the Examiner, Applicant submits that paragraph [0154] of KATAYAMA (as discussed above) does not teach this additional subject matter.

Claims 1 and 23 each further recite, inter alia, "wherein the collimator lens is fixed at a predetermined location during assembly of the optical system."

In the Official Action, the Examiner acknowledges that the combination of SHIMOZONO and KATAYAMA lacks any disclosure of such feature, but the Examiner contends that such feature is disclosed by TADOKORO et al.

However, Applicant submits that the collimator lens in KATAYAMA is disclosed as having a *movable* collimator lens for spherical aberration correction. Accordingly, Applicant submits that the *fixed position* collimator lens system of TADOKORO et al. is non-analogous to the *movable* collimator lens system of KATAYAMA. Applicant further submits that providing a *fixed position* collimator would clearly destroy the teachings of KATAYAMA which requires a *movable* collimator lens for spherical aberration correction. Finally, Applicant submits that the modification suggested by the Examiner would constitute an impermissible modification of a modification.

Applicant submits that the various modifications suggested by the Examiner (as discussed above) would not have been obvious to one having

ordinary skill in the art, and that such modifications are clearly the result of impermissible hindsight reasoning, based upon the disclosure of the present application, rather than being based upon the teachings of the references themselves. Applicant further submits that the Examiner has not provided proper statements of motivation for such modifications, or for combining the teachings of the references.

Applicant further submits that the dependent claims 6 and 9, which are at least patentable due to their dependency from claim 1, for the above-noted reasons, recite additional features of the invention and are also separately patentable over the prior art of record.

Accordingly, Applicant submits that the rejection of claims 1, 6 and 9 under 35 U.S.C. §103(a) is improper at least for each, and certainly for all, of the above-noted reasons. Applicant respectfully requests withdrawal of this rejection under 35 U.S.C. §103(a). Applicant further submits that newly presented claims 23-29 are also allowable, for at least the above-noted reasons. Accordingly, Applicant respectfully requests an early indication of the allowance of all of the pending claims.

On pages 5 and 6 of the Official Action, claims 2-4 were rejected under 35 U.S.C. §103(a) as being unpatentable over SHIMOZONO in view of KATAYAMA, and further in view of IKENAKA et al. and NISHIWAKI.

Applicant respectfully traverses these rejections under 35 U.S.C. §103(a).

As an initial matter, Applicant submits that the teachings of IKENAKA et al. and NISHIWAKI do not cure the deficiencies in the disclosures of SHIMOZONO,

KATAYAMA and TADOKORO et al., as noted above with regard to claims 1 and 23.

Applicant further submits that the dependent claims 2-4, which are at least patentable due to their dependency from claim 1, for the above-noted reasons, recite additional features of the invention and are also separately patentable over the prior art of record. In this regard, Applicant submits that the modifications suggested by the Examiner would not have been obvious to one having ordinary skill in the art, and that such modifications are clearly the result of impermissible hindsight reasoning, based upon the disclosure of the present application, rather than being based upon the teachings of the references themselves.

Accordingly, Applicant submits that the rejections of claims 2-4 under 35 U.S.C. §103(a) are improper at least for each, and certainly for all, of the above-noted reasons. Applicant respectfully requests withdrawal of these rejections under 35 U.S.C. §103(a), and an early indication of the allowance of all of the pending claims.

On pages 6-8 of the Official Action, claims 10, 11 and 13 were rejected under 35 U.S.C. §103(a) as being unpatentable over SHIMOZONO in view of ARAI et al. and KATAYAMA.

Applicant respectfully traverses this rejection under 35 U.S.C. §103(a).

Claim 10 recites, inter alia, "first and second collimator lenses disposed between said objective lens and said first and second light sources, respectively, so as to adjust diverging/converging angles of said first and second light beams

entering said objective lens".

In the Official Action, the Examiner acknowledges that SHIMOZONO lacks any disclosure of first and second collimator lenses, but contends that providing first and second collimator lenses would have been obvious in view of the teachings of ARAI et al.

Applicant submits that the modification suggested by the Examiner based upon the teachings of ARAI et al. would not have been obvious to one having ordinary skill in the art, and that such modification is clearly the result of impermissible hindsight reasoning, based upon the disclosure of the present application, rather than being based upon the teachings of the references themselves. Applicant further submits that the Examiner has not provided a proper statement of motivation for such modification, or for combining the teachings of the references. Applicant also submits that the additional modification of the system of SHIMOZONO suggested by the Examiner, as discussed below, would clearly constitute an impermissible modification of a modification.

Claim 10 further recites, inter alia, "wherein said first and second collimator lenses are located so as to respectively correct change in spherical aberration of said first and second light beams caused by wavelength deviations from design wavelengths of said first and second light beams due to individual specificity of said first and second light sources."

In the Official Action, the Examiner acknowledges that SHIMOZONO lacks any disclosure of such feature, but the Examiner contends that such feature is

disclosed by KATAYAMA.

In this regard, Applicant notes that paragraph [0154] of KATAYAMA discusses adjusting the position of a collimator lens 2 in order to cancel *spherical aberration due to variation in the substrate thickness* of a disk 7. However, Applicant submits that KATAYAMA lacks any disclosure of locating collimator lenses in order to correct for *change in spherical aberration due to wavelength deviations from design wavelengths due to individual specificity of light sources.*

Accordingly, Applicant submits that the teachings of KATAYAMA can not reasonably be characterized as curing the deficiencies in the disclosure of SHIMOZONO, particularly with regard to the *correction of spherical aberration resulting from wavelength variation of light sources.* Even assuming, arguendo, that the teachings of the references discussed by the Examiner were to be combined, Applicant submits that such a modified system would not result in the invention defined in the claims.

Claim 10 further recites, inter alia, "wherein the first collimator lens is located at a first optimum position so that the spherical aberration of said first light beam converged onto the recording layer of the first optical disc is minimized, wherein the second collimator lens is located at a second optimum position so that the spherical aberration of said second light beam converged onto the recording layer of the second optical disc is minimized, and wherein the first and second collimator lenses are fixed at the first and second optimum positions, respectively, during assembly of the optical system."

Applicant submits that the combination of SHIMOZONO, ARAI et al. and

KATAYAMA, as applied by the Examiner lacks any disclosure or teaching of such features. Applicant further submits that the collimator lens in KATAYAMA is disclosed as having a *movable* collimator lens for spherical aberration correction, as noted above. Applicant submits that providing a *fixed position* collimator would clearly destroy the teachings of KATAYAMA which requires a *movable* collimator lens for spherical aberration correction. Further, Applicant submits that any such modification would clearly constitute an impermissible modification of a modification.

Applicant submits that the various modifications suggested by the Examiner (as discussed above) would not have been obvious to one having ordinary skill in the art, and that such modifications are clearly the result of impermissible hindsight reasoning, based upon the disclosure of the present application, rather than being based upon the teachings of the references themselves. Applicant further submits that the Examiner has not provided proper statements of motivation for such modifications, or for combining the teachings of the references.

Applicant further submits that the dependent claims 11 and 13, which are at least patentable due to their dependency from claim 10, for the above-noted reasons, recite additional features of the invention and are also separately patentable over the prior art of record. In this regard, Applicant submits that the modifications suggested by the Examiner would not have been obvious to one having ordinary skill in the art, and that such modifications are clearly the result of impermissible hindsight reasoning, based upon the disclosure of the present

application, rather than being based upon the teachings of the references themselves.

Accordingly, Applicant submits that the rejection of claims 10, 11 and 13 under 35 U.S.C. §103(a) is improper at least for each, and certainly for all, of the above-noted reasons. Applicant respectfully requests withdrawal of this rejection under 35 U.S.C. §103(a), and an early indication of the allowance of all of the pending claims.

On pages 8 and 9 of the Official Action, claim 12 was rejected under 35 U.S.C. §103(a) as being unpatentable over SHIMOZONO in view of ARAI et al. and KATAYAMA, and further in view of IKENAKA et al.

Applicant respectfully traverses this rejections under 35 U.S.C. §103(a).

As an initial matter, Applicant submits that the teachings of IKENAKA et al. do not cure the deficiencies in the disclosures of SHIMOZONO, ARAI et al. and KATAYAMA as noted above with regard to claim 10.

Applicant further submits that the dependent claim 12, which is at least patentable due to its dependency from claim 10, for the above-noted reasons, recites additional features of the invention and is also separately patentable over the prior art of record. In this regard, Applicant submits that the modifications suggested by the Examiner would not have been obvious to one having ordinary skill in the art, and that such modifications are clearly the result of impermissible hindsight reasoning, based upon the disclosure of the present application, rather than being based upon the teachings of the references themselves.

Accordingly, Applicant submits that the rejection of claim 12 under 35

U.S.C. §103(a) is improper at least for each, and certainly for all, of the above-noted reasons. Applicant respectfully requests withdrawal of this rejection under 35 U.S.C. §103(a), and an early indication of the allowance of all of the pending claims.

On pages 9 and 10 of the Official Action, claims 14, 15 and 17-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over SHIMOZONO in view of NISHIWAKI et al. Applicant submits that this rejection is now moot, and Applicant respectfully requests withdrawal of this rejection.

COMMENTS ON REASONS FOR ALLOWANCE

In regard to the Examiner's indication of allowable subject matter in claim 5 on page 11 of the Official Action, Applicant does not disagree with the Examiner's indication that the prior art fails to disclose or teach various features of this claim. However, Applicant wishes to make clear that the claims in the present application recite a combination of features, and that the patentability of these claims is also based on the totality of the features recited therein, which define over the prior art. Thus the reasons for allowance should not be limited to those mentioned by the Examiner.

SUMMARY AND CONCLUSION

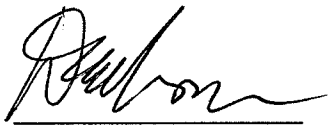
Entry and consideration of the present amendment, reconsideration of the outstanding Official Action, and allowance of the present application and all of the claims therein are respectfully requested and now believed to be appropriate.

Applicant has made a sincere effort to place the present application in condition for allowance and believes that he has now done so.

Any amendments to the claims that have been made in this amendment, which do not narrow the scope of the claims, and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered cosmetic in nature, and to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto.

Should there be any questions or comments, the Examiner is invited to contact the undersigned at the below-listed telephone number. .

Respectfully Submitted,
Shuichi TAKEUCHI



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